



⑪ Publication number : **0 633 106 A1**

⑫ **EUROPEAN PATENT APPLICATION**

⑲ Application number : **94304880.1**

⑤① Int. Cl.⁶ : **B27G 19/02**

⑳ Date of filing : **04.07.94**

③① Priority : **08.07.93 GB 9314164**

④③ Date of publication of application :
11.01.95 Bulletin 95/02

⑧④ Designated Contracting States :
DE ES FR GB IT SE

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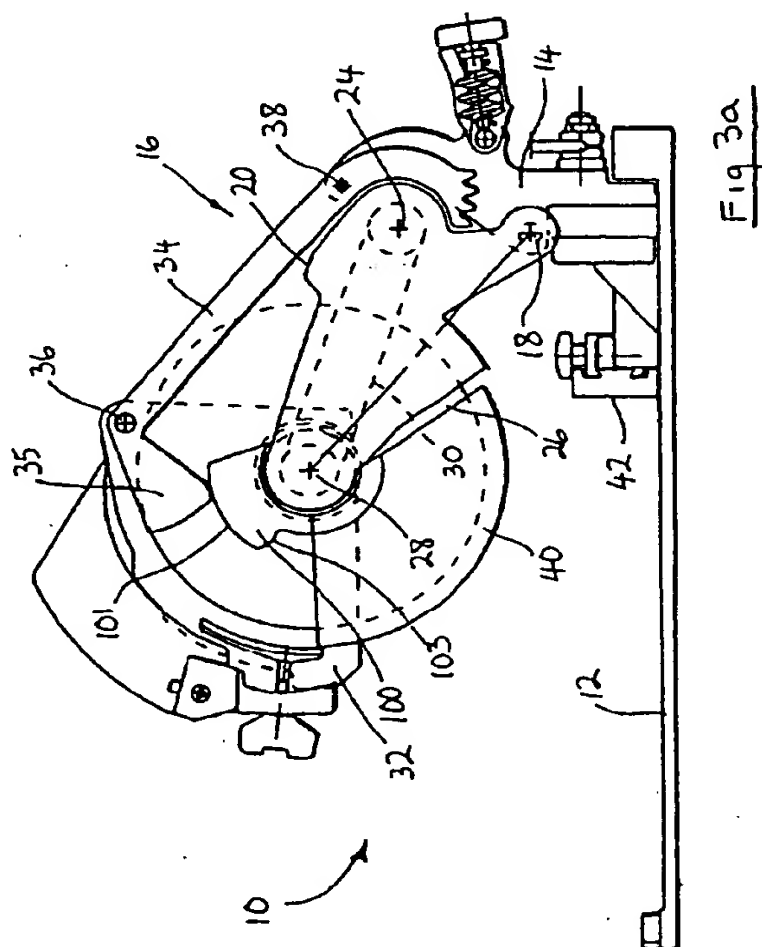
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⑤④ **Chop saw arrangement.**

⑤⑦ A chop saw (10) comprises a table (12), a pivot member (14) on the table, a saw assembly (16) pivoted about axis (18) to the pivot member, a blade (26) journaled in said assembly, a motor (22) to drive the blade, an upper guard (32) to cover an upper portion of said blade, which upper guard is pivoted to said assembly, and a lower guard (40) to cover a lower portion of said blade, which lower guard is also pivoted to said assembly, both about the blade axis (28).

A parallelogram lever (34) has a pivoted connection to the pivot member (38) and upper guard (36) to maintain the orientation of the upper guard in all pivot positions of the assembly. An extension (35) of the parallelogram lever co-operates a flange (100) on the lower guard such that, in a raised rest position of the saw assembly and in an unopened position of the lower guard, the extension engages the flange and prevents downward pivoting of the assembly.

An actuator (94) opens the lower guard to an extent sufficient to rotate the flange out of abutment with the extension, whereupon subsequent downward pivoting of the saw assembly serves to engage the extension with a cam surface of the flange to open further the lower guard.



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This invention relates to circular saws of the type comprising a table, a pivot member on the table and a saw assembly pivoted about a pivot axis with respect to said pivot member, whereby said saw assembly carrying a motor driven blade can be plunged into a workpiece supported on the table.

Such saws are known and described in published patent documents such as EP 0133666 and EP 0450400. These saws are useful and have numerous possibilities for enhancement to improve the capacity, capability and efficiency, not to mention cleanliness and safety of their arrangements. On the other hand, all these features add complexity and cost, and may render the saw user unfriendly.

Both EP 0133666 and EP 0450400 mentioned above describe saws in which the saw assembly comprises an upper guard and a lower guard for the blade. The upper guard is formed from or on the housing of the assembly and permanently covers a top part of the blade. A bottom part of the blade is covered by the lower guard, but thus must be withdrawn in use so that the blade is exposed when required to perform cutting operations.

A handle is disposed on the upper guard or housing by means of which a user can pivot the saw assembly up and down to perform cutting operations on a workpiece supported on the table.

The lower guard may be opened entirely by an actuating lever disposed on said handle. Alternatively the guard may be opened automatically by pivoting of the saw assembly, there being provided a connection between the guard and the pivot member for this purpose. A further alternative is that the guard may be opened partly by either of these arrangements and only further opened by direct contact with a workpiece. None of these is ideal or covers every desirable eventuality. In particular it is desirable only to open the guard as much as is necessary to cut the workpiece and no more, otherwise the dangerous blade is needlessly exposed. In any event, it is desirable (and, indeed, essential in some jurisdictions) to provide the following two safety features: first, a lock on the lower guard so that it cannot be manipulated open except by proper operation of the saw; and second, a lock on the saw assembly so that it cannot pivot down from a rest position except by proper operation, involving a release of the lock.

It is an object of the present invention to provide a saw of the type described above which provides a good compromise between the often conflicting requirements of ease of use versus safety of use.

In accordance with the present invention there is provided a saw comprising a table, a pivot member on the table, a saw assembly pivoted with respect to the pivot member, a blade journaled in said assembly, a motor to drive the blade, an upper guard to cover an upper portion of said blade, which upper guard is pivoted to said assembly, a lower guard to cover a lower

portion of said blade, which lower guard is pivoted to said assembly, a parallelogram lever having a pivoted connection to the pivot member and upper guard to maintain the orientation of said upper guard with respect to pivot member in all pivot positions of the assembly with respect to said pivot member, and an extension of said parallelogram lever co-operating with said lower guard such that, in a raised rest position of the saw assembly with respect to said pivot member and in an unopened position of said lower guard with respect to said blade, said extension engages said lower guard and prevents pivoting of the assembly with respect to said pivot member, means being provided to open said lower guard to an extent sufficient to remove abutment thereof with said extension, whereupon subsequent pivoting of said saw assembly from said raised position serves to engage said extension with said lower guard to open further said lower guard.

Preferably said lower guard comprises a flange engaged by said extension and said guard opening means rotates said flange out of abutment with said extension and said flange has a cam surface engaged by said extension on said subsequent pivoting of the saw assembly to further rotate and open said lower guard.

Preferably said extension and flange co-operate sufficiently to open the guard only as much as necessary with typically found workpieces to avoid contact of the lower guard with such workpieces, the guard being capable of further opening on contact thereof with non-typical workpieces.

Preferably, said means to open said lower guard comprises an actuator lever connected with said lower guard to open said lower guard a first amount sufficient to withdraw said flange from abutment with said extension.

Preferably said actuator lever has means engaging said lower guard such that said guard cannot be opened without first activating said lever.

Thus the above arrangement provides two safety features. Firstly, the lower guard cannot be opened without first activating the lever. Thus accidents occasioned by unintentionally or carelessly manipulating the lower guard when the saw is in its raised, at-rest position can be avoided. Secondly, the assembly cannot be pivoted down until the lock formed by the extension abutting the flange is released. This is only achieved by opening the guard by activating said lever. Not only is this a safety feature but also, as a practical matter, it is desirable for the guard to be open before plunging of the assembly into a workpiece, so as to avoid contact of the lower guard with the workpiece.

Preferably, the actuator lever is connected to said lower guard by a cable which has a small amount of dead-slack in it so that the guard is not opened until the lever disengages the guard. Preferably the cable

passes through an eye in said lever and is captivated on said guard so that the guard pushes the cable through said eye when the guard is further opened by said extension on said flange or by opening contact with a workpiece.

Preferably, said assembly comprises a housing mounting said motor and an axle disposed in a wall of said housing, a hollow spindle journaled for rotation about said axle on one side of said housing and carrying said blade. Said lower guard may be mounted on said axle on the other side of said housing. Preferably, the housing has a cylindrical section around said spindle and said lower guard has a cup-shaped part supported on said cylindrical section.

Preferably, said upper guard is mounted on said axle beyond said lower guard with respect to said wall of the housing. The motor may drive said spindle through a belt surrounding said spindle.

This provides an especially compact, self-supportive structure which also facilitates assembly.

The invention is further described hereinafter, by way of example only, with reference to the accompanying drawings, in which:-

Figures 1a, b and c are sections through a saw assembly according to the present invention and taken along the line A-A, B-B, and C-C respectively in Figures 4c and 4d;

Figures 2a to d are views showing the lower guard opening arrangements of a saw according to the present invention;

Figures 3a to d are side views in different positions of a saw according to the present invention;

Figures 4a to d are more detailed side views of a different embodiment of the present invention in different positions, Figure 4a being a section on the line G-G in Figure 1d and Figures 4b to d being sections on the line F-F in Figure 1d; and Figures 5a to d are similar views to those given above of another embodiment of the present invention.

Referring first to Figure 3a, a saw 10 according to the invention comprises a table 12 having a pivot member 14 to which a saw assembly 16 is pivoted about axis 18.

The saw assembly 16 comprises a housing 20 mounting a motor 22 (see also Figure 1b) having a rotation axis 24. The motor 22 drives a circular saw blade 26 mounted in the housing 20 about axis 28 through a belt 30 drive connection.

An upper guard 32 is pivotally mounted in the housing 20 about axis 28. It is connected to the pivot member 14 by parallelogram lever 34 pivoted at both ends about axes 36,38. Lines joining axes 36,38 and 18,28 are parallel.

A lower guard 40 is likewise pivotally mounted in the housing 20 about axis 28. It is opened by means explained further below to expose the blade 26. When this is done, the assembly 16 is capable of piv-

oting down about axis 18 to plunge the blade 26 into a workpiece (not shown) supported on the table 12 against a fence 42. The table 12 has a slot 13 (see Figure 1c) through which the blade passes as the assembly pivots down to the position shown in Figure 3d.

The parallelogram lever 34 maintains the orientation of the upper guard 32 with respect to the pivot member 14 and hence the table 12.

Turning now to Figures 1a to d, the housing 20 mounts a blade axle 44 which passes through a bore 46 in wall 48 of the housing. The axle 44 is clamped against housing 20 between flange 56 of axle 44 and a nut 58.

A drive spindle 60 comprises a sleeve which is rotatably journaled on the axle 44 through bearings 62. The bearings 62 are first slid onto the shaft 44, together with intermediate spacer 63, until they abut flange 56. They are held in place by circlip 64. Then the sleeve 60 is slid over the bearings 62 and spacer 63 before being retained in position by circlip 66. The assembly so formed is then inserted in, and bolted to, the housing 20 by nut 58.

The closed end of the sleeve 60 has a flange 68 on which a flange washer 70 is seated. On flange 72 of the washer 70 the blade 26 is seated before a bolt 74 clamps the assembly together.

The spindle 60, and hence blade 26, is driven by belt 30, which is around the bearings 62 so that the load on the bearings is entirely radial. Moreover, the bearings are near the blade 26 so that the side forces produced by contact of the blade with the workpiece are minimised.

The motor 22 is shown in Figures 1b and d, and has an output shaft 21 journaled in the housing 20 through bearings 23. A pulley 25 is on the shaft 21 and around which the belt 30 is passed.

The housing 20 extends between pivot member 14 (at pivot axis 18, see also Figure 3a), the motor 20 (at axis 24) and the axle 44, surrounding the belt 30 and sleeve 60. It extends backwards (relative the blade 26) to capture the axle 44 at 46 and also forwards to form a fixed guard 76 of the blade 26. The guard 76 covers a rear portion of the blade 26, and opens into a rearwardly directed dust collection chute 77.

Around sleeve 60, the housing 20 is cylindrical and rotatably supports a part cylindrical cup 78 being a part of lower guard 40. The cup 78 has a bore 80 in its base through which the shaft 44 passes. The cup is retained in position by a sleeve 82 of upper guard 32. Sleeve 82 is likewise rotatably supported on the shaft 44 and is retained by a nut 84 which retains sleeve 82 and cup 78 against shoulder 86 of the shaft 44.

Lower guard 40 has a segmental section 39 which covers a lower portion of the blade 26. In Figure 1a it is shown in dashed lines in an open position, exposing the blade 26 from which it can be seen that it

is outside of the housing 76 with respect to the blade.

The lower guard is opened initially by a cable 88 wound around cup 78 and terminating at 90, the cable rotating the cup 78 and guard 40 around shaft 44. The other end of the cable passes through an eye 92 (see Figures 2a to d) in an actuator lever 94 pivoted at 95 to a handle 96 forming part of the upper guard 32.

The lower guard is biased to the closed position thereof (which is shown in Figure 2a) by a spring 98 which extends between the upper guard 32 and a flange 100 on the cup 78.

The actuator lever has an extension 102 which engages a stop 104 on the cup 78. The guard 40 cannot be manipulated open until the extension 102 is withdrawn from the stop 104. This occurs during the first movement of the actuator lever 94 and this position is shown in Figure 2b.

The cable 88 passes freely through the eye 92. However, at the position shown in Figure 2b said other end of the cable, indicated at 91 in Figure 2, engages the eye 92. Thereafter, further pivoting of the actuator lever 94 tensions the cable 88 and begins to open the guard 40, tensioning the spring 98 as shown in Figure 2c.

Figure 2c shows the fully pulled position of the lever 94, although the guard 40 is only partially open. However, by means explained further below the guard may be fully opened as shown in Figure 2d and in this case the tension in the cable 88 is again relaxed and is fed through the eye 92 into a space in the handle 96. The actuator lever 94 may itself be biased by a spring (not shown) to the position shown in Figure 2a. Release of the actuator in the position of the guard 40 shown in Figure 2d would then return the actuator to the Figure 2a position. As the guard is permitted to return to its closed position (again as explained further below), stop 104 engages curved rear surface 103 of the extension 102 and opens the actuator sufficient to allow passage of the stop before the extension snaps back into the locking position shown in Figure 2a.

Returning now to Figures 3a to d the saw 10 is shown in four positions in which the lower guard 40 is in positions corresponding to positions shown in Figure 2, that is to say Figure 2a corresponds with Figure 3a; Figure 2c corresponds with Figure 3b; and Figure 2d corresponds approximately with Figure 3d.

The parallelogram lever 34 has an extension 35 which abuts top surface 101 of the flange 100. Analysis of the geometry of the arrangement demonstrates that saw assembly 16 cannot pivot downwards from the position shown in Figure 3a about axis 18 while extension 35 abuts flange 100. Thus this fulfils the safety requirement that, in the raised at-rest position of the saw assembly as shown in Figure 3a, there is a lock to hold the assembly in that position. The lock is released by opening the guard 40 as described above to the position shown in Figure 2c and

Figure 3b. Here the flange 100 has moved out from underneath the extension 35 and so the assembly is now permitted to pivot about axis 18.

In Figure 3c, the assembly 16 is pivoted down about axis 18 to cut workpieces positioned on the table 12 against fence 42. Between the positions in Figures 3b and c, the extension 35 engages a cam surface 103 of the flange 100 so that downward movement of the assembly 16 opens further the guard 40. In Figure 3d, the guard is fully withdrawn inside the upper guard 32.

The arrangement is organised so that for most typical workpieces of rectangular cross-section the lower guard 40 is always opened by the extension 35 before the guard contacts the workpiece, but does not open so much that a dangerous amount of the blade is exposed above and in front of the workpiece. Obviously some compromises have to be made and the arrangement is more effective for some workpieces than it is for others. However, for awkward shapes which do not fit the geometry of this arrangement, the guard 40 can be opened by contact with the workpiece on its bottom edge 41. This facility appertains once the guard has opened to the position in Figure 3b and, for example, the lower guard could be fully opened as in Figure 3d even when the assembly 16 is in the position in Figure 3c if the shape of the workpiece dictated this. In this event, cam surface 103 is separated from extension 35.

On the other hand, mere release of actuator lever 94 does not return the guard 40 to its fully closed position. This is only achieved when the assembly 16 is raised sufficiently to allow the guard flange 100 to slide under the extension 35.

An alternative arrangement is feasible in which the flange 100 is provided with a circumferential rack in front of it (not shown, but at position 106) around the cup 78 and the bottom 108 of the extension 35 is likewise provided with teeth (not shown) to engage the rack and provide a positive connection between the guard 40 and parallelogram lever 34. This would have the advantage that the guard could not be manipulated open once the respective teeth had engaged but would have a twofold disadvantage. Firstly, to cater for typical awkward shapes of workpiece, the guard 40 would have to be arranged to be opened quite fully at an early stage of descent of the assembly. This would lead to more exposure of the blade above and in front of the workpiece for more regularly shaped workpieces than is desirable, or indeed as is provided by the preferred arrangement. Secondly, should even this measure be insufficient on some workpieces to prevent contact between the guard edge 41 and the workpiece, the saw assembly would become jammed and be prevented from further descent because the guard cannot open without downward movement of the assembly. Hence further cutting of the workpiece could not be accomplished.

Thus the arrangement first described above employing simple contact between extension 35 and cam surface 103 to open the guard 40 is preferred.

Figures 4a to d show the above described arrangements in more detail. Here, extension 35' has a different shape. Also extension 102' of the actuator lever 94 is different in that it is long in order to fill the aperture (not shown) in the base of the handle 96 through which it passes in all conditions of the actuator, ie in every position thereof. Part 105 is connected to the base of the extension 102' and it is this part which engages stop 104' in the edge of the cup 78 (passing through an opening 107 in the upper guard 32) and which carries eye 92.

Figures 1a and d also show an alternative arrangement of the lower guard return spring 98' described with reference to Figures 2a to d. Here, (see especially Figure 1d) a coil spring 98' is wound around flange 109 of upper guard 32 around sleeve 82, one end 98a being turned radially inwardly and engaging flange 109 and the other end 98b passing through an arcuate slot 111 (see also Figure 4b) in the upper guard 32 and engaging the lower guard cup 78. A cap 113 retains the spring in position, while a circlip on sleeve 82 retains the cap.

Figures 5a to d show another arrangement for the return spring 98'' which is here connected to the upper guard 32 at 98''a and to a lug 98''b of the lower guard cup 78 which passes through an arcuate slot 111' in the upper guard 32.

Finally, above the actuator lever 94 there is formed in the handle 96 a trigger switch 117 by which to start and stop the motor 22. Around axis 18 a coil spring 119 is provided which supports the weight of the saw assembly 16.

Claims

1. A saw comprising a table, a pivot member on the table, a saw assembly pivoted with respect to the pivot member, a blade journaled in said assembly, a motor to drive the blade, an upper guard to cover an upper portion of said blade, which upper guard is pivoted to said assembly, a lower guard to cover a lower portion of said blade, which lower guard is pivoted to said assembly, a parallelogram lever having a pivoted connection to the pivot member and upper guard to maintain the orientation of said upper guard with respect to pivot member in all pivot positions of the assembly with respect to said pivot member, and an extension of said parallelogram lever co-operating with said lower guard such that, in a raised rest position of the saw assembly with respect to said pivot member and in an unopened position of said lower guard with respect to said blade, said extension engages said lower guard and prevents pivoting

of the assembly with respect to said pivot member, means being provided to open said lower guard to an extent sufficient to remove abutment thereof with said extension, whereupon subsequent pivoting of said saw assembly from said raised position serves to engage said extension with said lower guard to open further said lower guard.

2. A saw as claimed in claim 1, in which said lower guard comprises a flange engaged by said extension and said guard opening means rotates said flange out of abutment with said extension and said flange has a cam surface engaged by said extension on said subsequent pivoting of the saw assembly to further rotate and open said lower guard.
3. A saw as claimed in claim 2, in which said extension and flange co-operate sufficiently to open the guard only as much as necessary with typically found workpieces to avoid contact of the lower guard with such workpieces, the guard being capable of further opening on contact thereof with non-typical workpieces.
4. A saw as claimed in claim 2 or 3, in which said means to open said lower guard comprises an actuator lever connected with said lower guard to open said lower guard a first amount sufficient to withdraw said flange from abutment with said extension.
5. A saw as claimed in claim 4, in which said actuator lever has means engaging said lower guard such that said guard cannot be opened without first activating said lever.
6. A saw as claimed in claim 5, in which the actuator lever is connected to said lower guard by a cable which has a small amount of dead-slack in it so that the guard is not opened until the lever disengages the guard.
7. A saw as claimed in claim 6, in which the cable passes through an eye in said lever and is captivated on said guard so that the guard pushes the cable through said eye when the guard is further opened by said extension on said flange or by opening contact with a workpiece.
8. A saw as claimed in any preceding claim, in which said assembly comprises a housing mounting said motor and an axle disposed in a wall of said housing, a hollow spindle journaled for rotation about said axle on one side of said housing and carrying said blade.

9. A saw as claimed in claim 8, in which said lower guard is mounted on said axle on the other side of said housing.
10. A saw as claimed in claim 9, in which said housing has a cylindrical section around said spindle and said lower guard has a cup-shaped part supported on said cylindrical section. 5
11. A saw as claimed in claim 9 or 10, in which said upper guard is mounted on said axle beyond said lower guard with respect to said wall of the housing. 10
12. A saw as claimed in any of claims 8 to 11, in which said motor drives said spindle through a belt surrounding said spindle. 15

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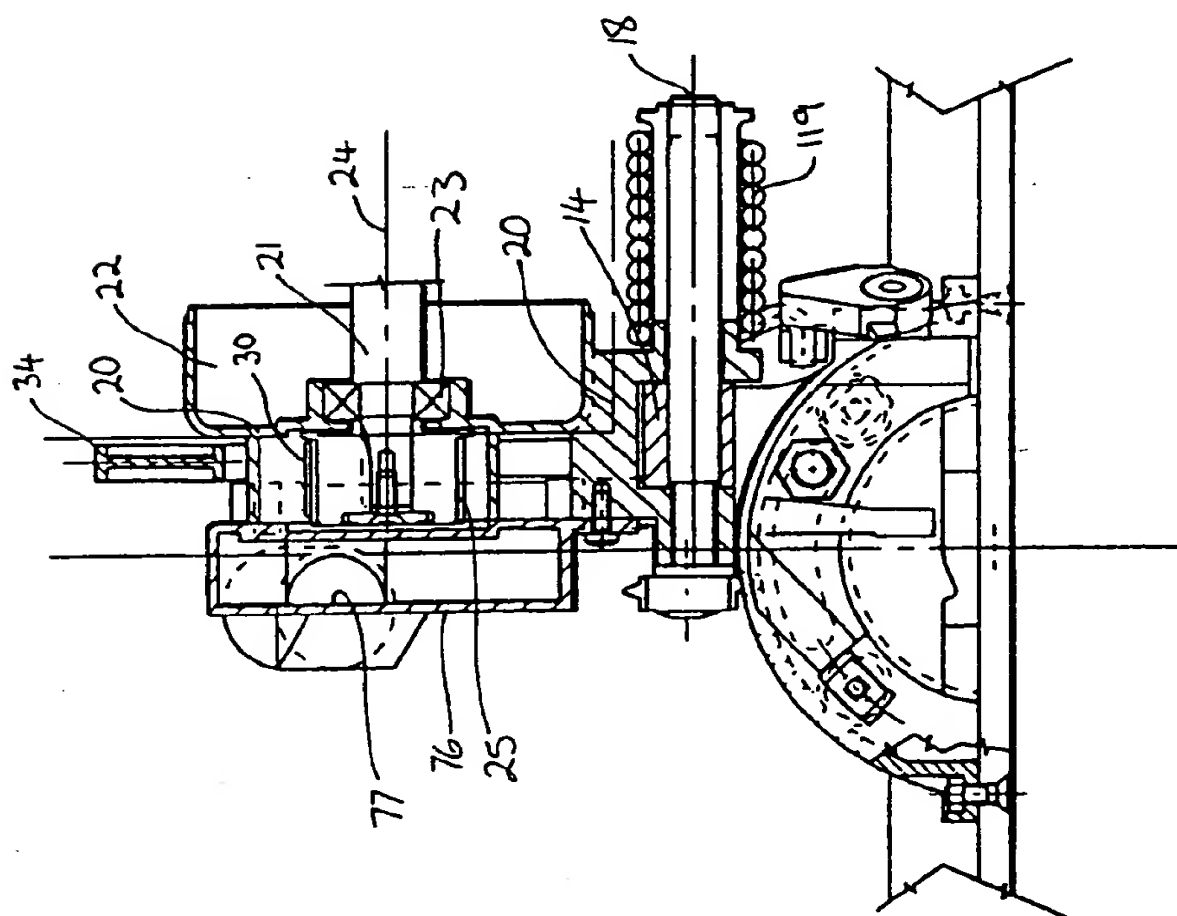


Fig. 1b

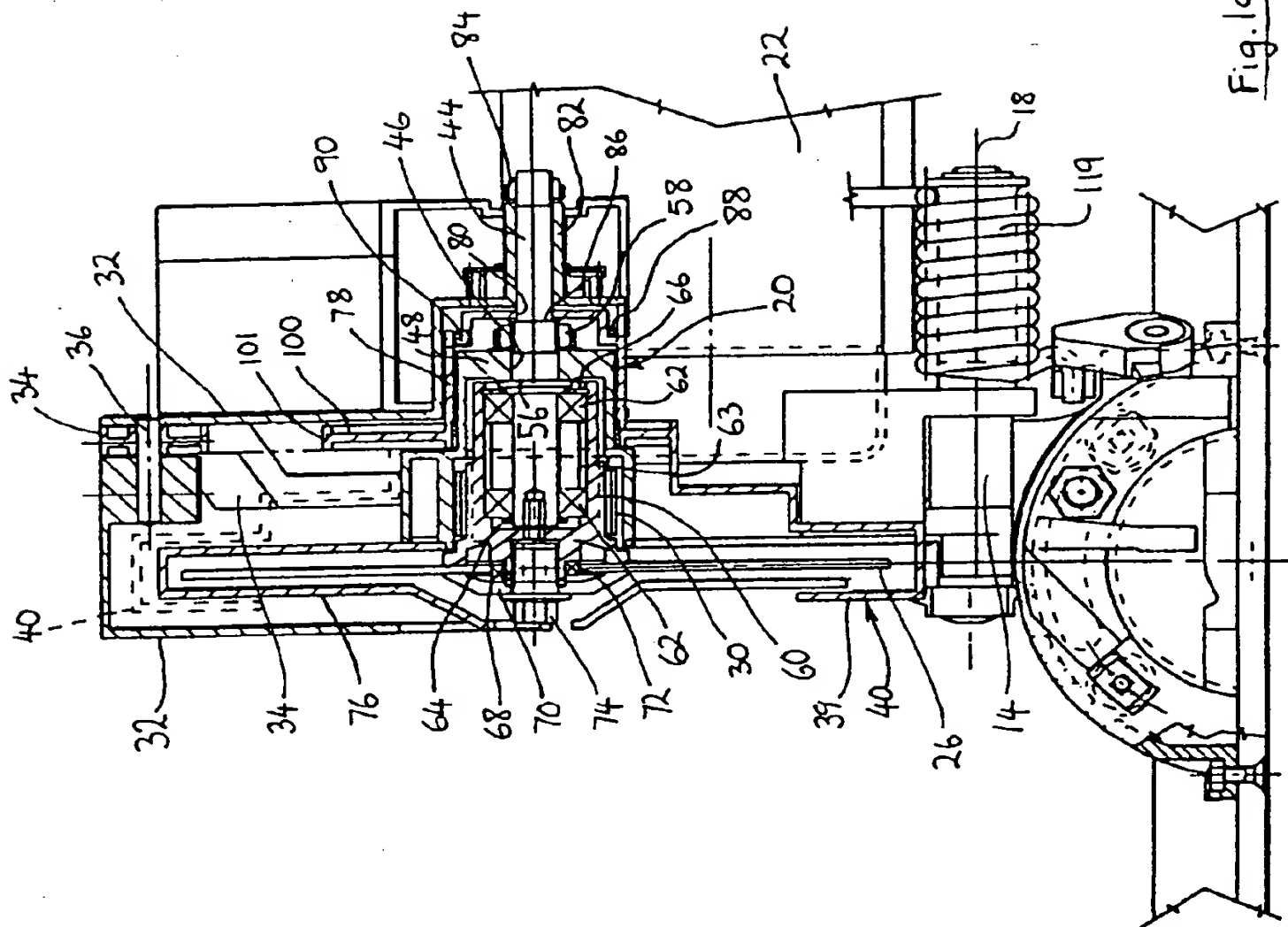
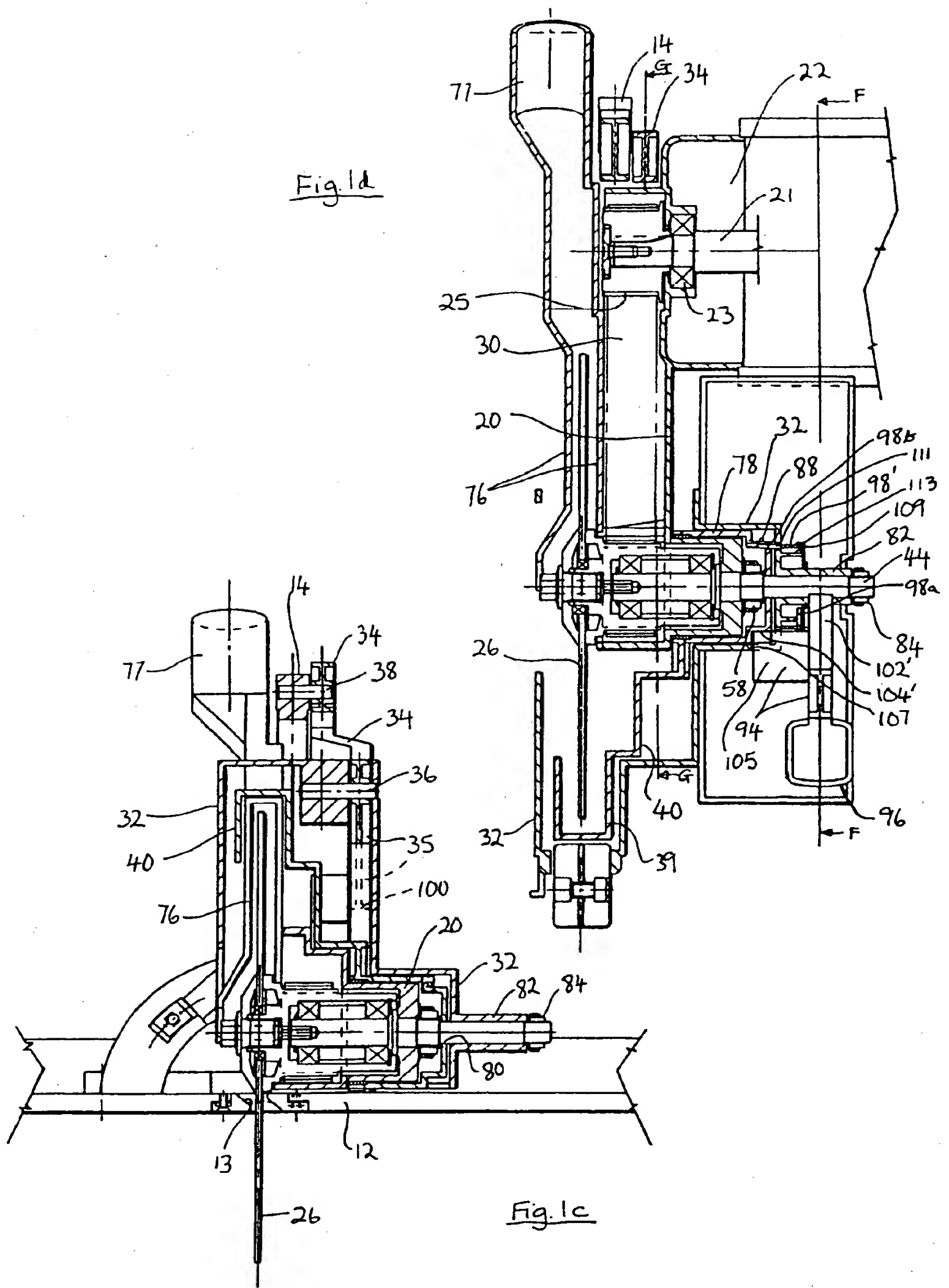


Fig. 1a



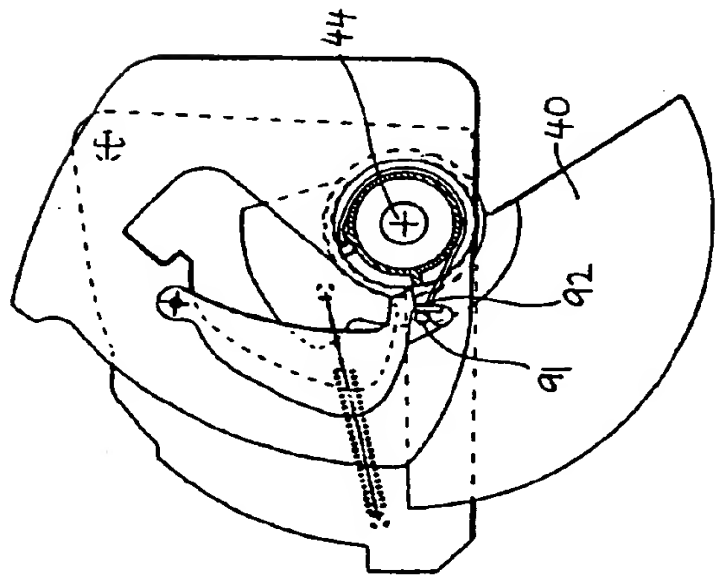
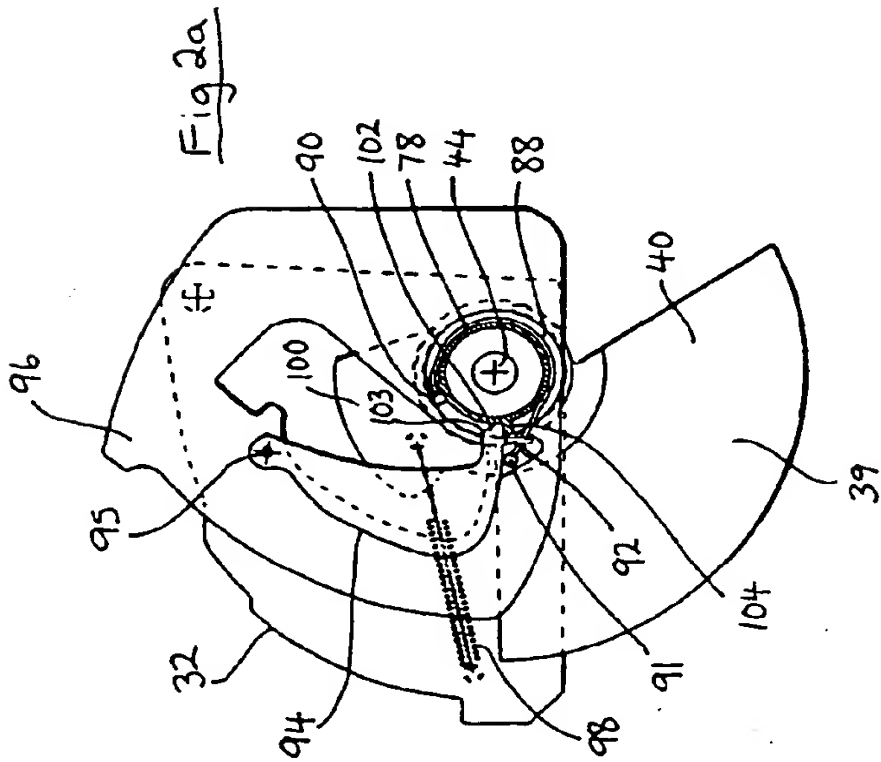
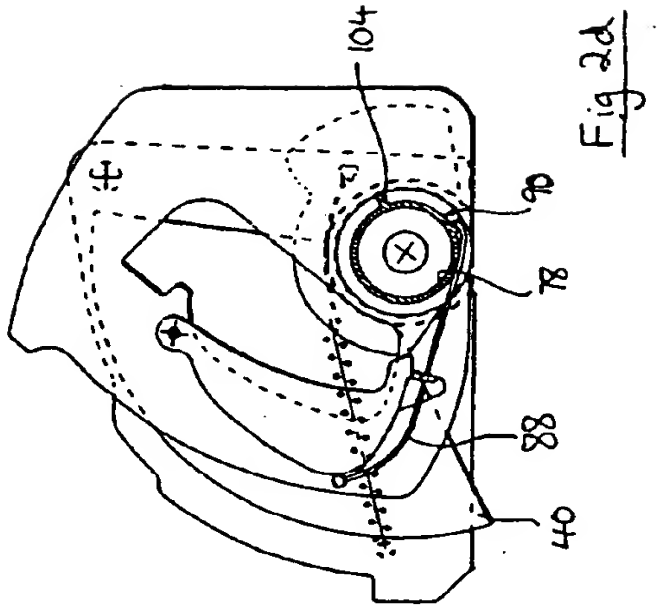
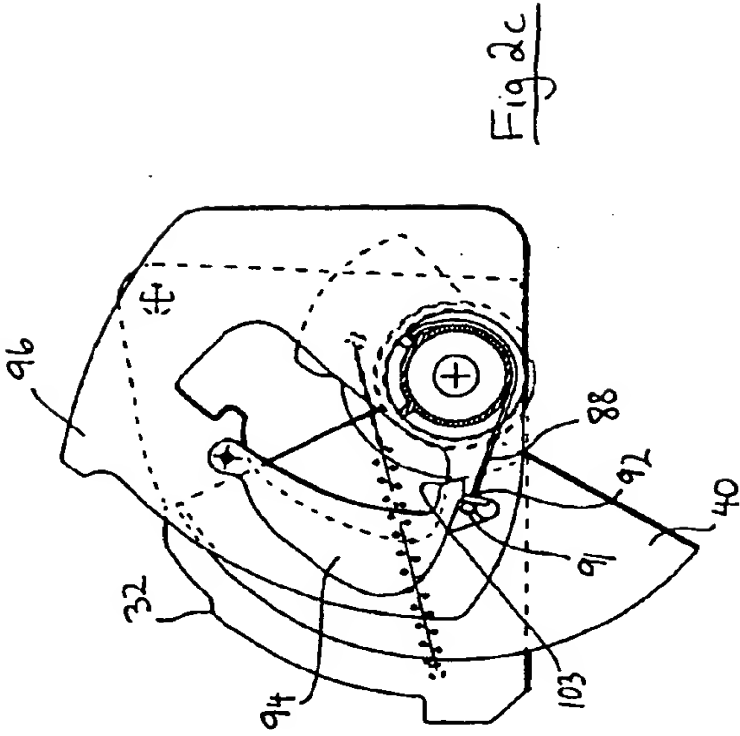
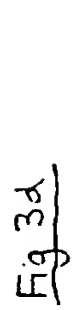
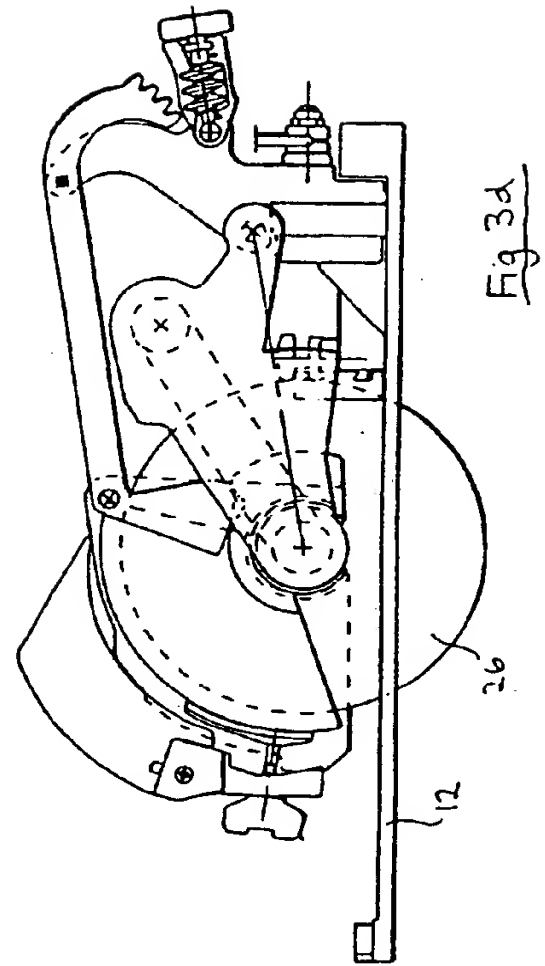
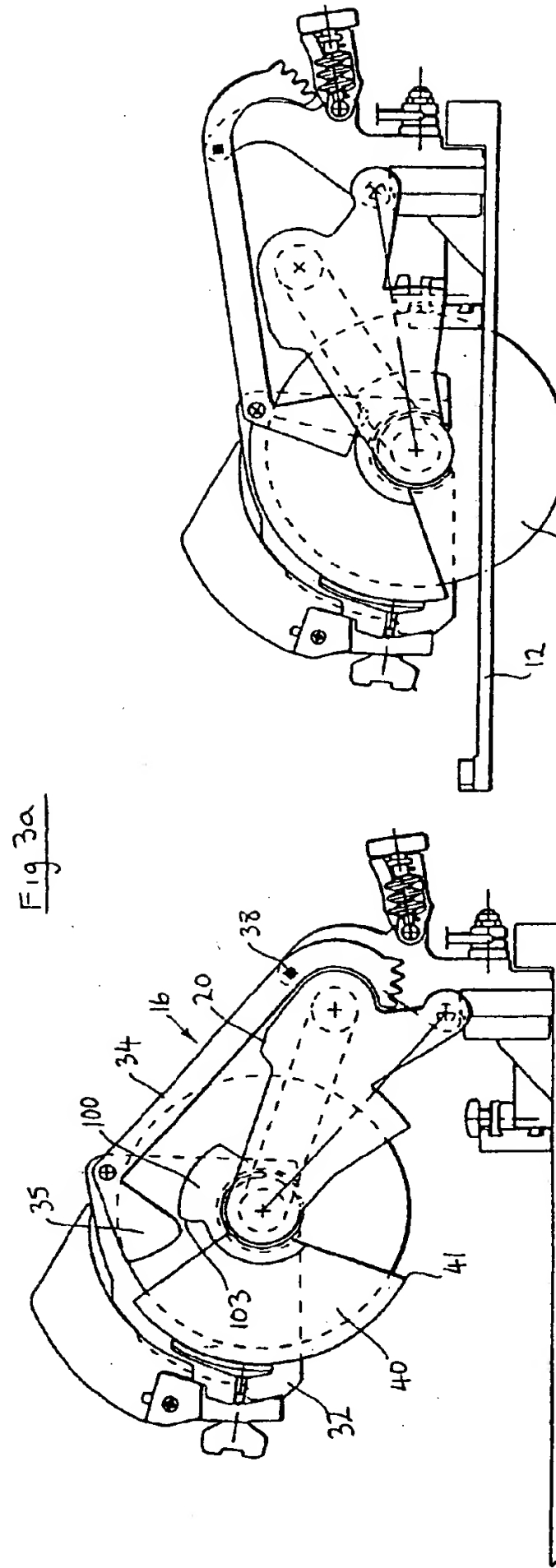
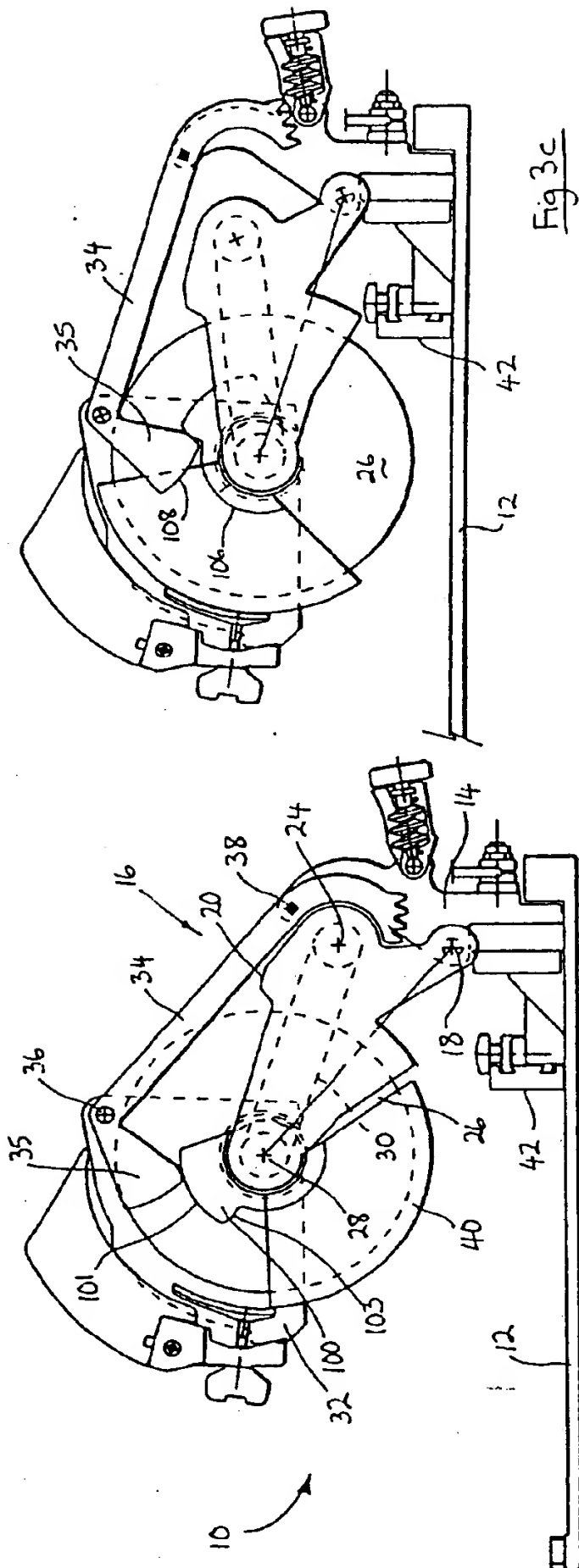
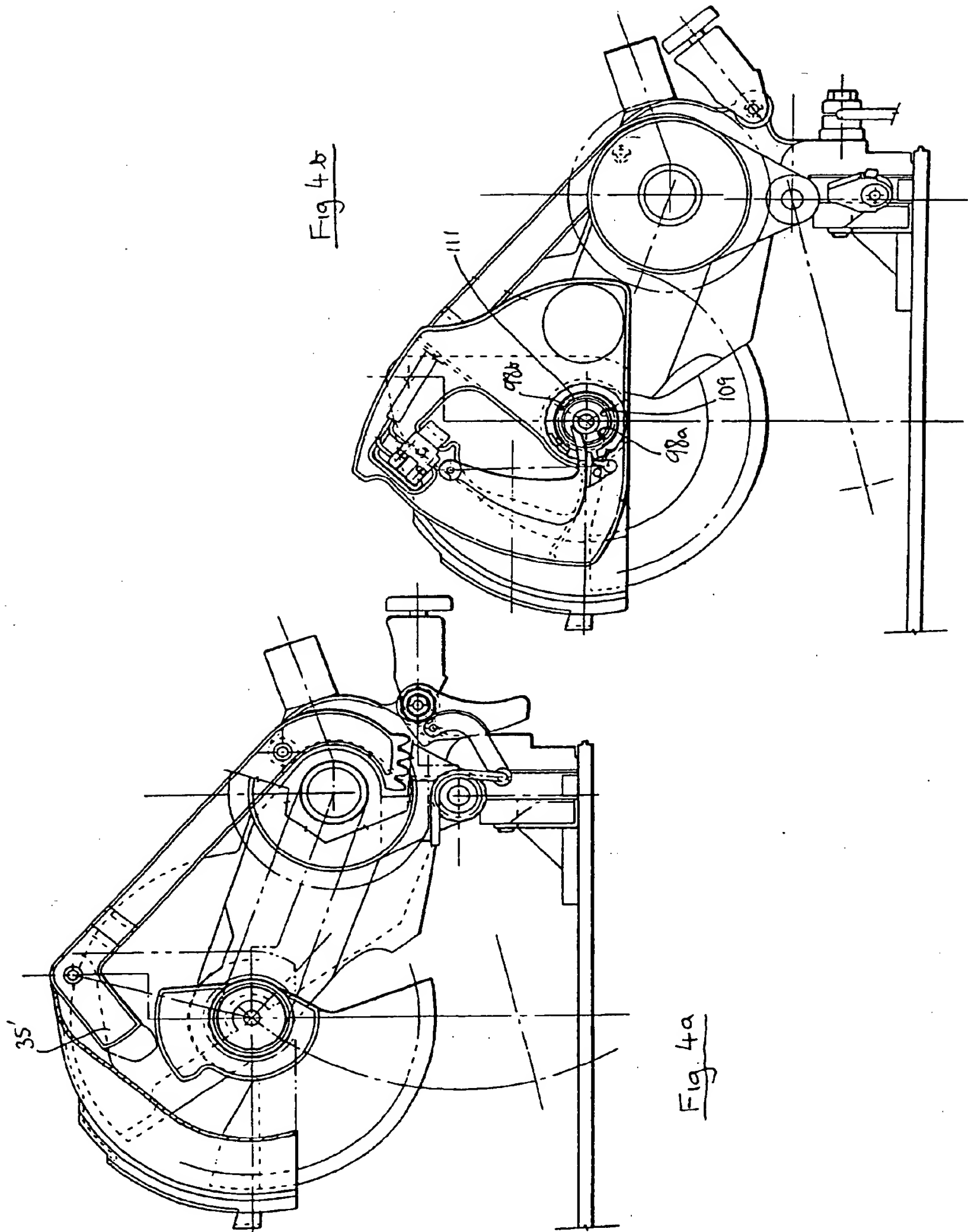
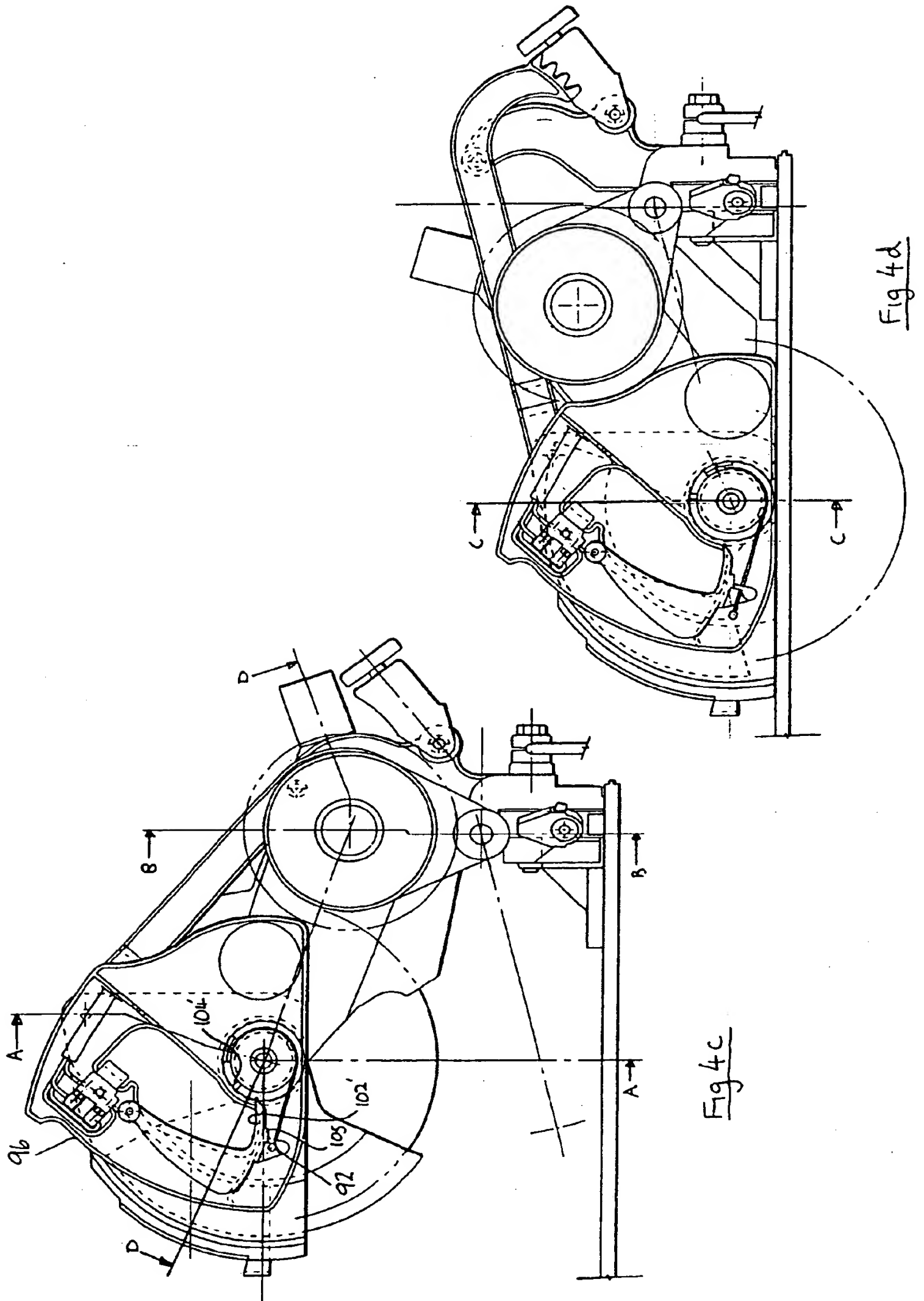


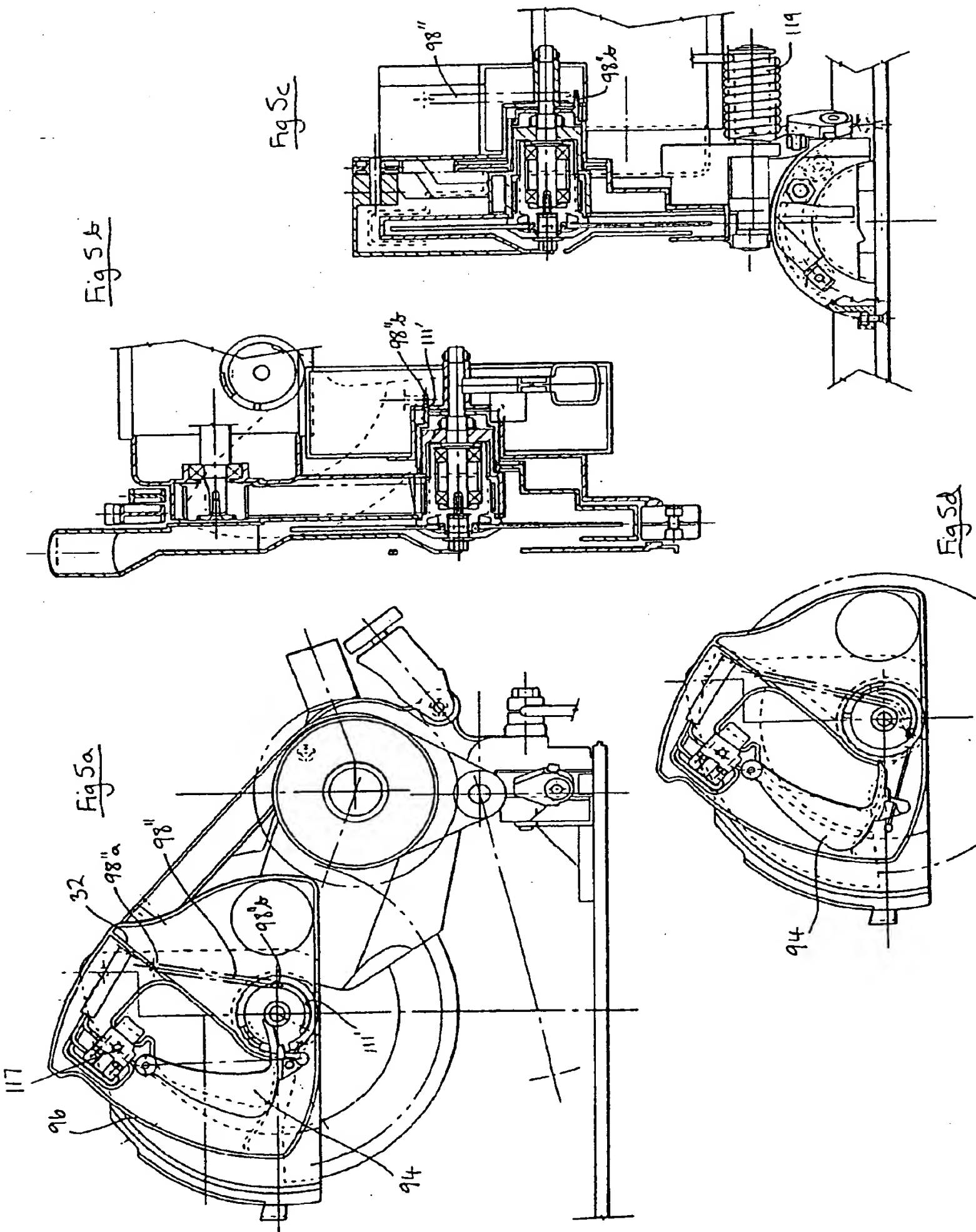
Fig 2b













European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 94 30 4880

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	EP-A-0 131 376 (BLACK & DECKER INC) * page 3, line 12 - line 25 * * page 4, line 15 - line 17 * * page 5, line 18 - line 28 * * page 7, line 6 - line 24 * * figures 1,2 * ---	1	B27G19/02
A	EP-A-0 538 066 (MAKITA CORP) * column 6, line 2 - column 7, line 26 * * figures 1-5B * ---	1	
A	FR-A-2 275 118 (CHR. EISELE MASCHINENFABRIK) ---		
D,A	EP-A-0 450 400 (ELEKTRA-BECKUM LUBITZ & CO) -----		
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B27G
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 18 October 1994	Examiner Moet, H
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